

Environmental Performance Surface for Support Underwater Laser Imaging Systems & Diver Operations



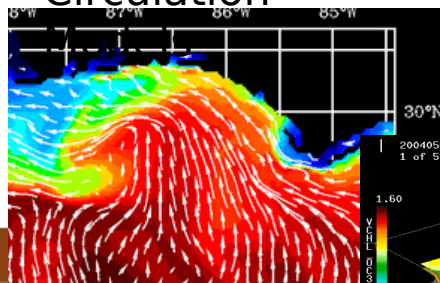
S. Ladner, R. Arnone, A. Weidemann
Stennis Space Center, MS

Proposed support to Vulcan Ex March 2011

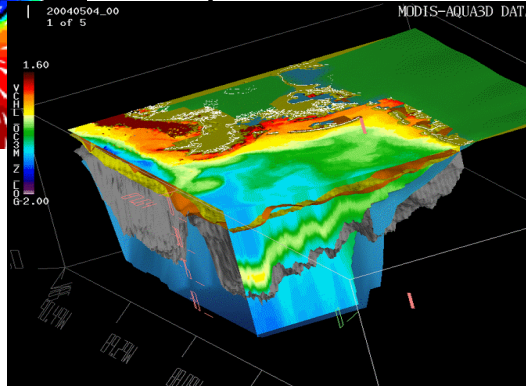
Environmental characterization for the Northern Gulf of Mexico

- a) Forecasting the Optical Environment ✉ Impact on systems (ASQ 24) and Diver visibility
- b) Vertical optical layers
- c) daily and 24 hour forecast of the EOIDS performance

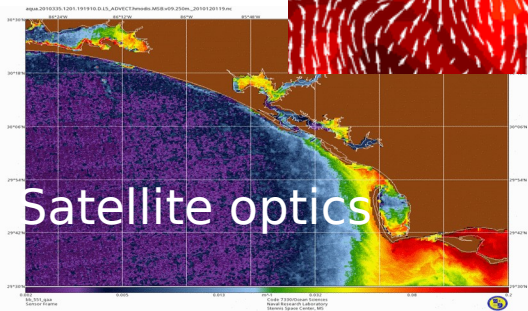
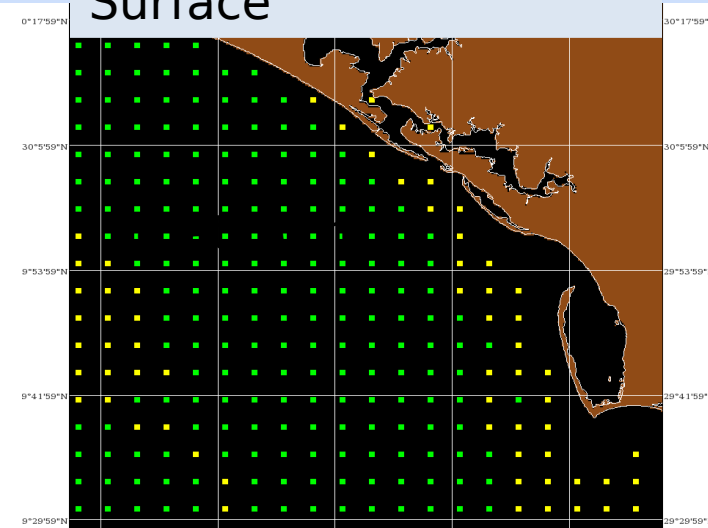
Circulation



3d optical volume



EOID performance
Surface



Satellite optics

Background:

Satellite ocean color Imagery from provides re monitoring of the optical properties in the Gulf



**250m
Resolution**

aqua.2010348.1214.184500.D.L3.hmodis.MSB.v06.250m.hdf

Total backscatter at 555 nm, QAA algorithm v5

Tue Dec 14 18:48:33 2010

Northern Gulf of Mexico

AL

**MODIS Aqua
December 14, 2010
1845 GMT**

FL

**Panama
City, FL**

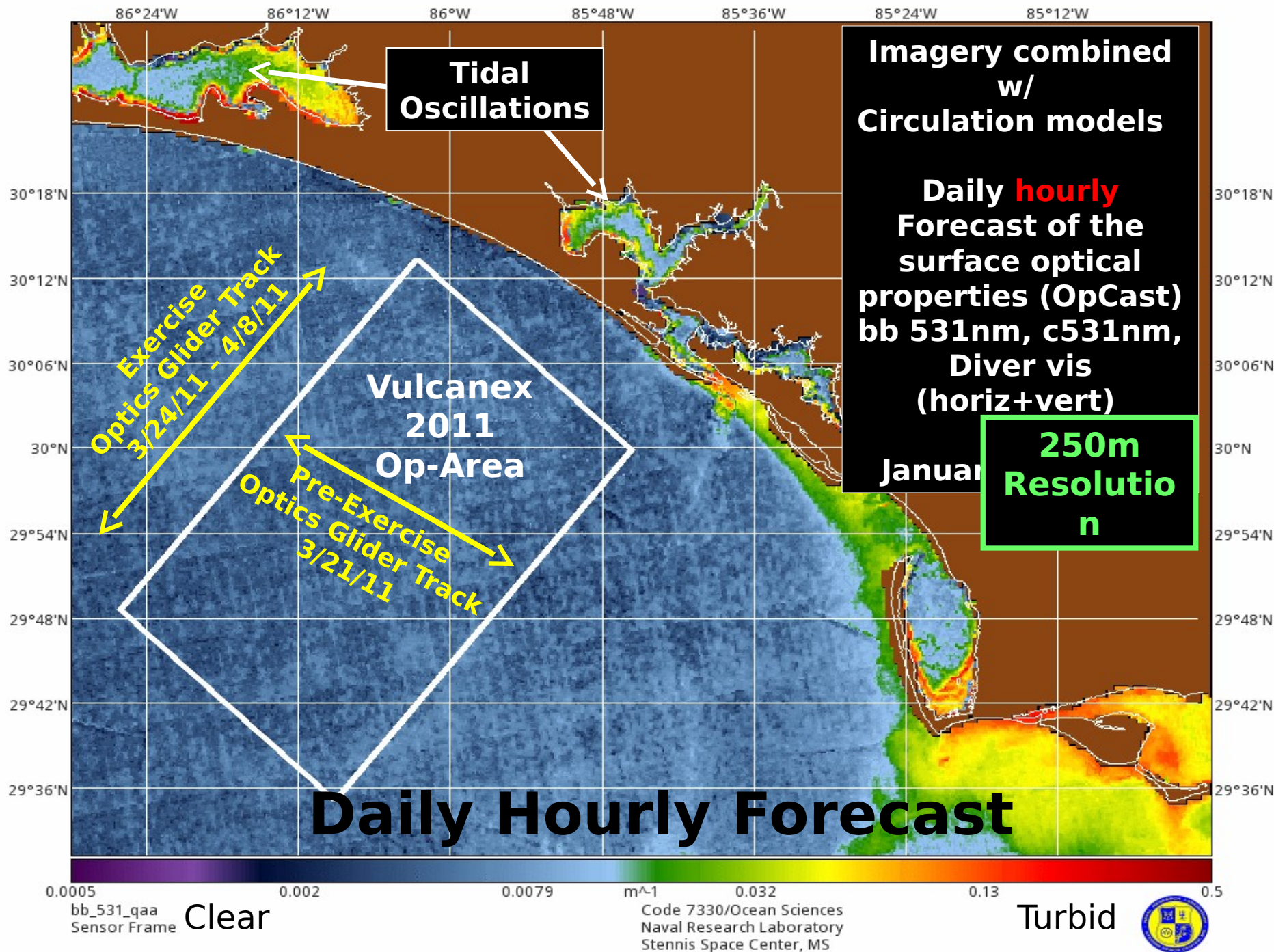
LA

MS

Daily Surface Turbidity
Beam attenuation Coefficient

CLDICE LAND ATMFAIL
bb_555_qaa (provisional)
Mississippi Bright (MODIS-AQUA-PM)
Version 9 (APS v3.8.2.1)

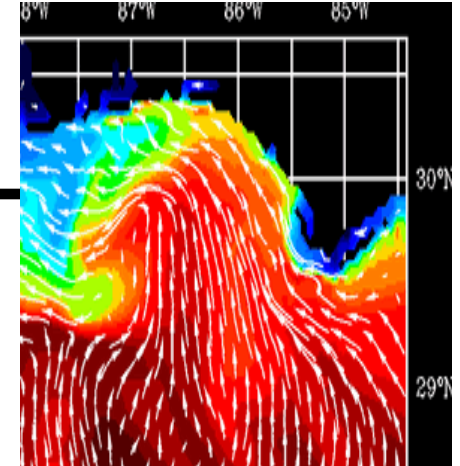
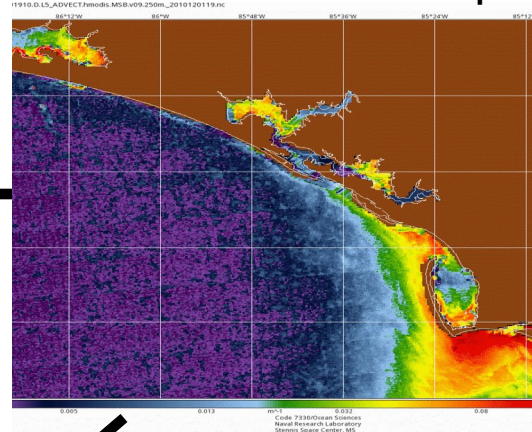
Code 7330/Ocean Sciences
Naval Research Laboratory
Stennis Space Center, MS





Real-Time Satellite Optics

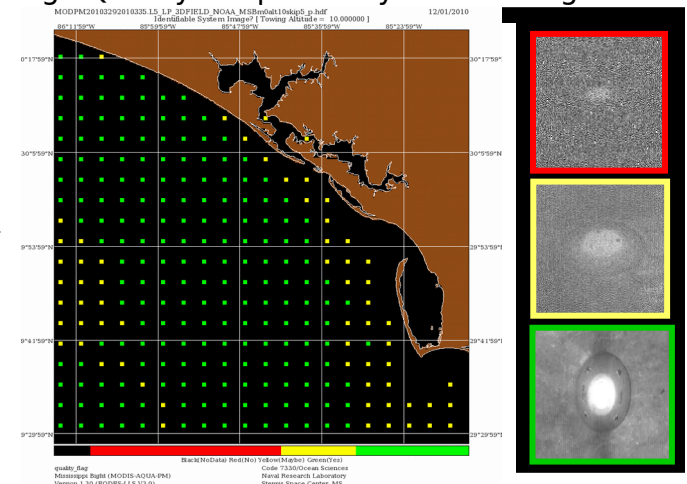
Circulation Models



EODES

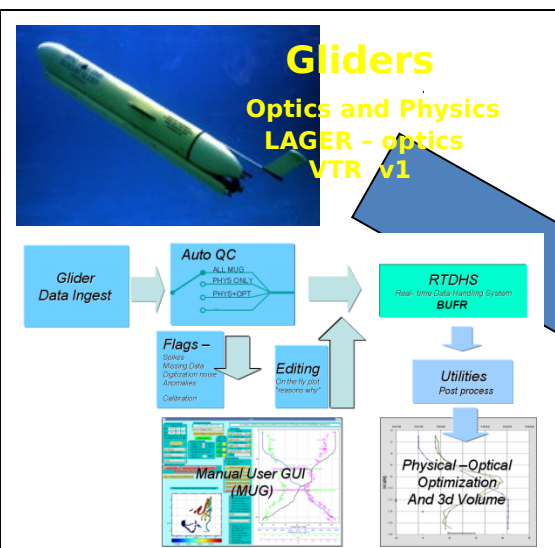
Laser System Performance Surface M

Image Quality & Optimal System Towing Altitude

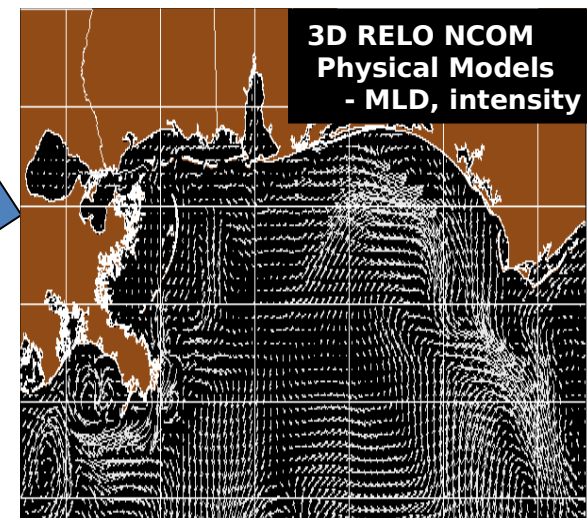
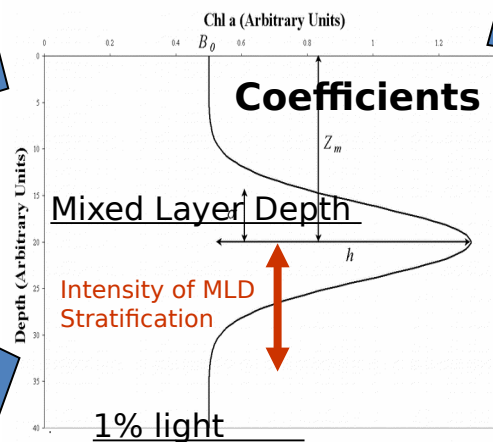


3D Optical Volume

Generation of the 3D Optical Volume (3DOG)

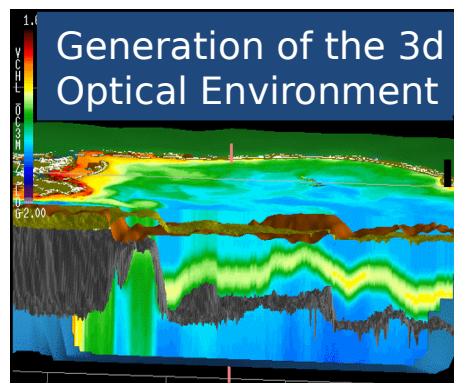
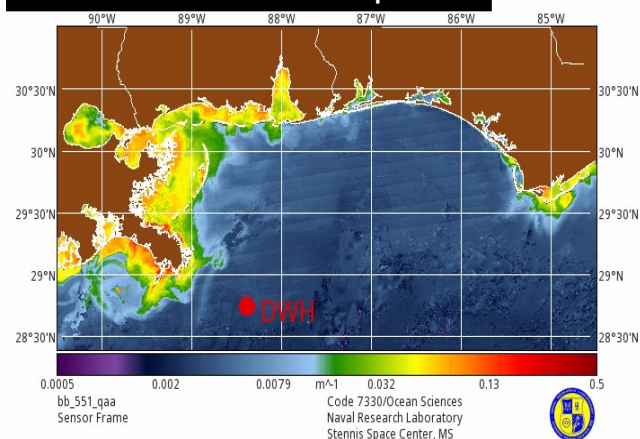


“Fusion of the data sources”
Optics (surface) to physics (subsurface)
Derived through optimization of a
Gaussian Model

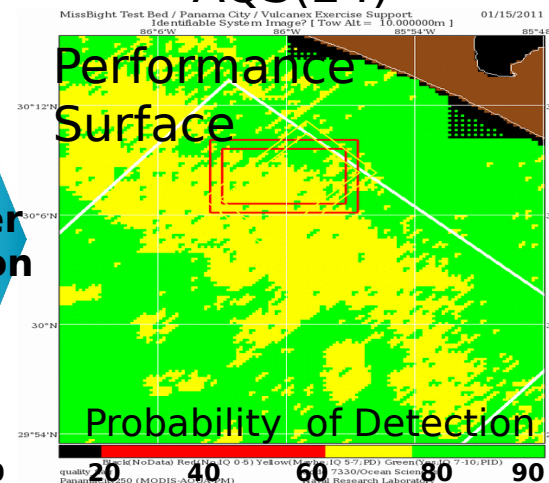


Environmental Decision Aides
For Operational Planning
EOIDS (EODES)
AQS(24)

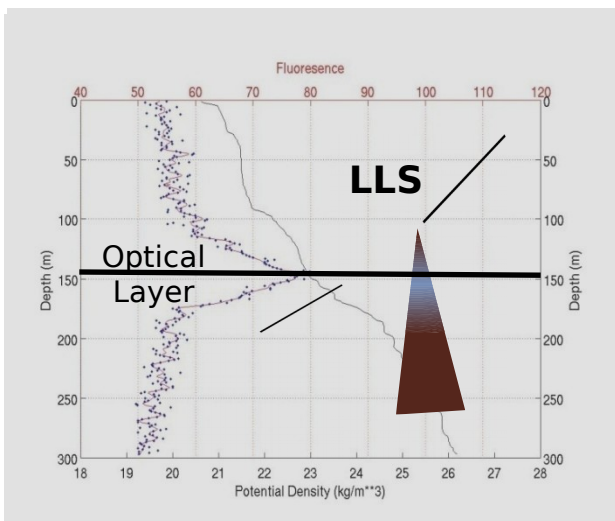
Satellite Surface Optics



Warfighter
Information



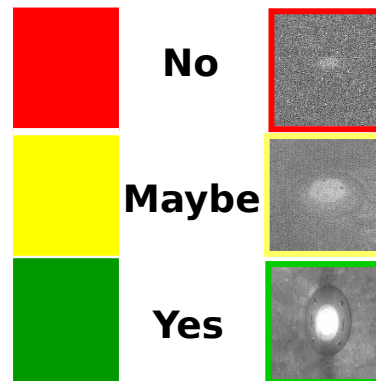
System Performance Surfaces (AQS-24)



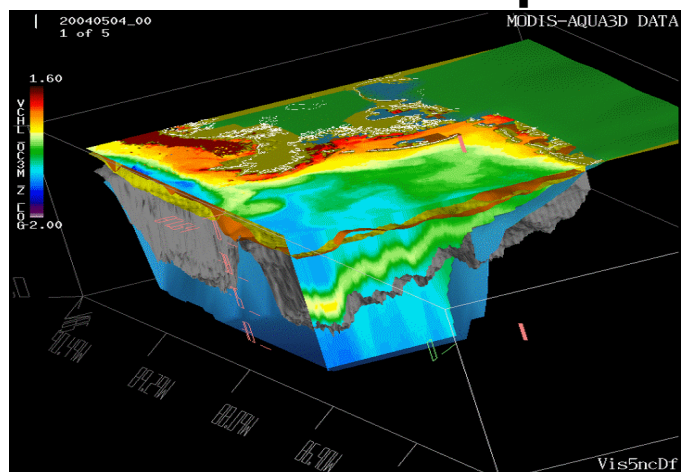
**EODES
Point Glider
Performance**

Tow **Above/Below**
Optical Layer

Target ID?

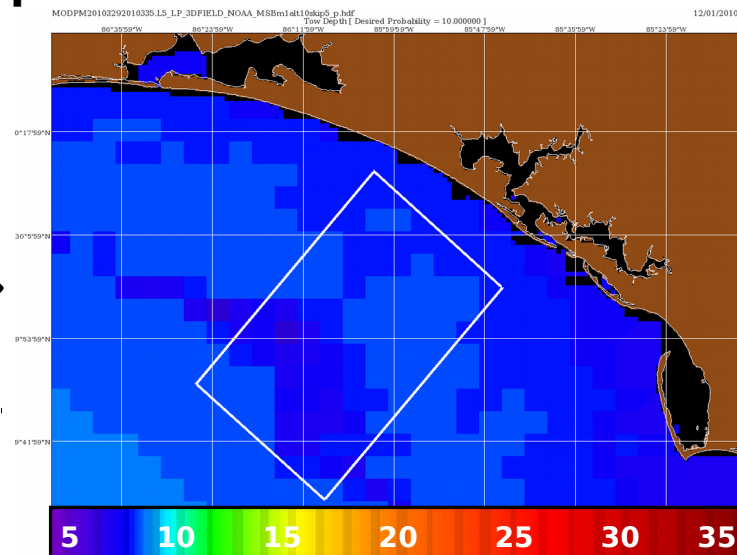


**and Vertical Glider Profiles Spatially
by EODES to the 3D Optical Volume**



**EODES Spatial
Performance**

Spatial Performance Surface Map

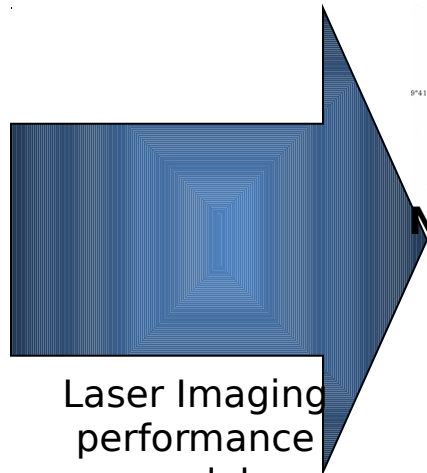
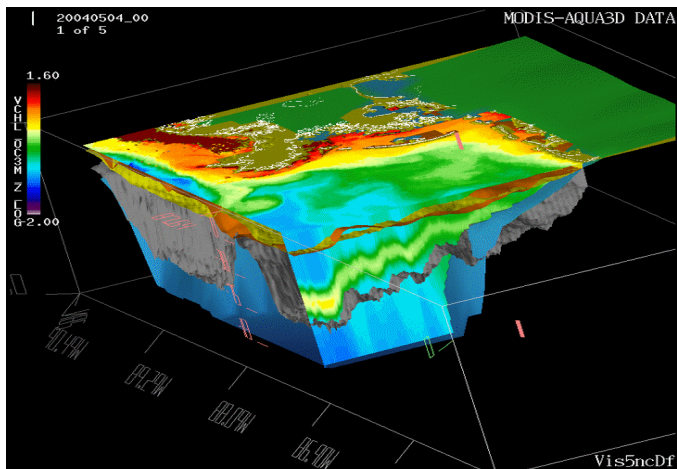


**Sensor Optimal Tow Altitude
(Meters)**



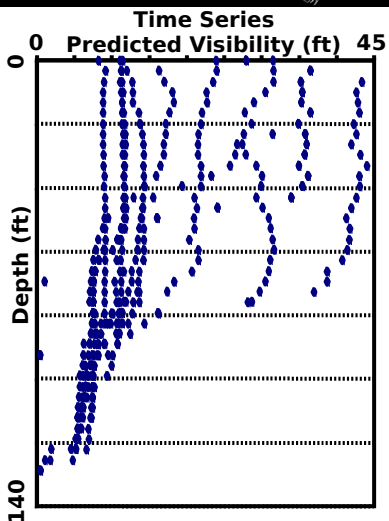
Performance Fields

Battlespace Characterization 3d optical profiles

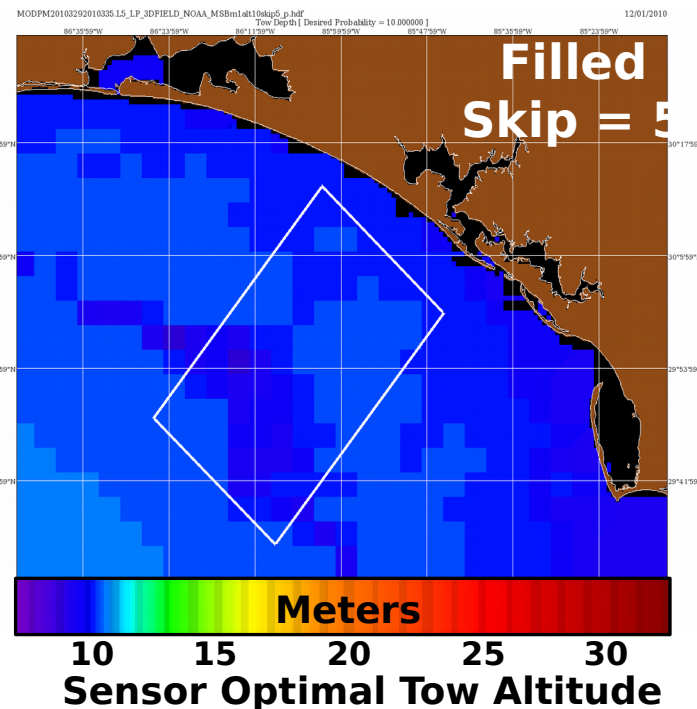
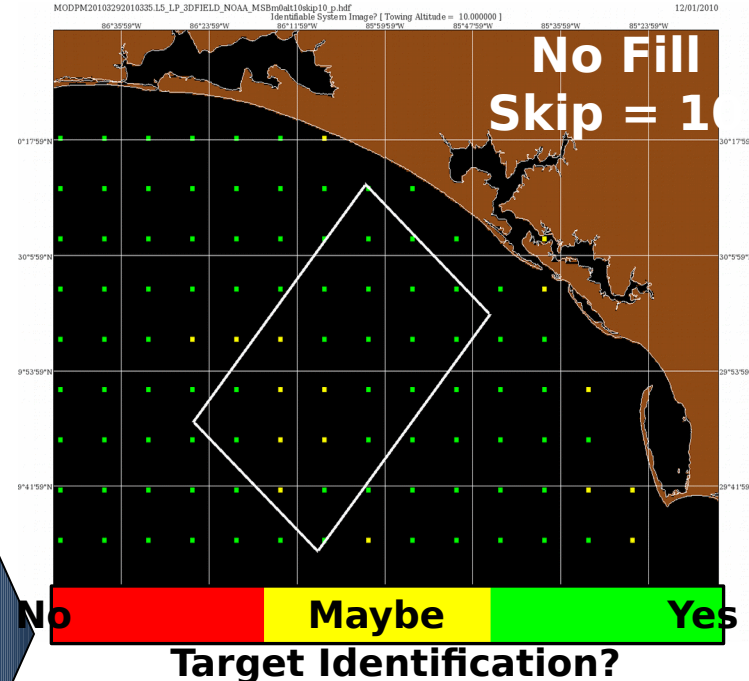


Laser Imaging
performance
models

Laser Line Scanner



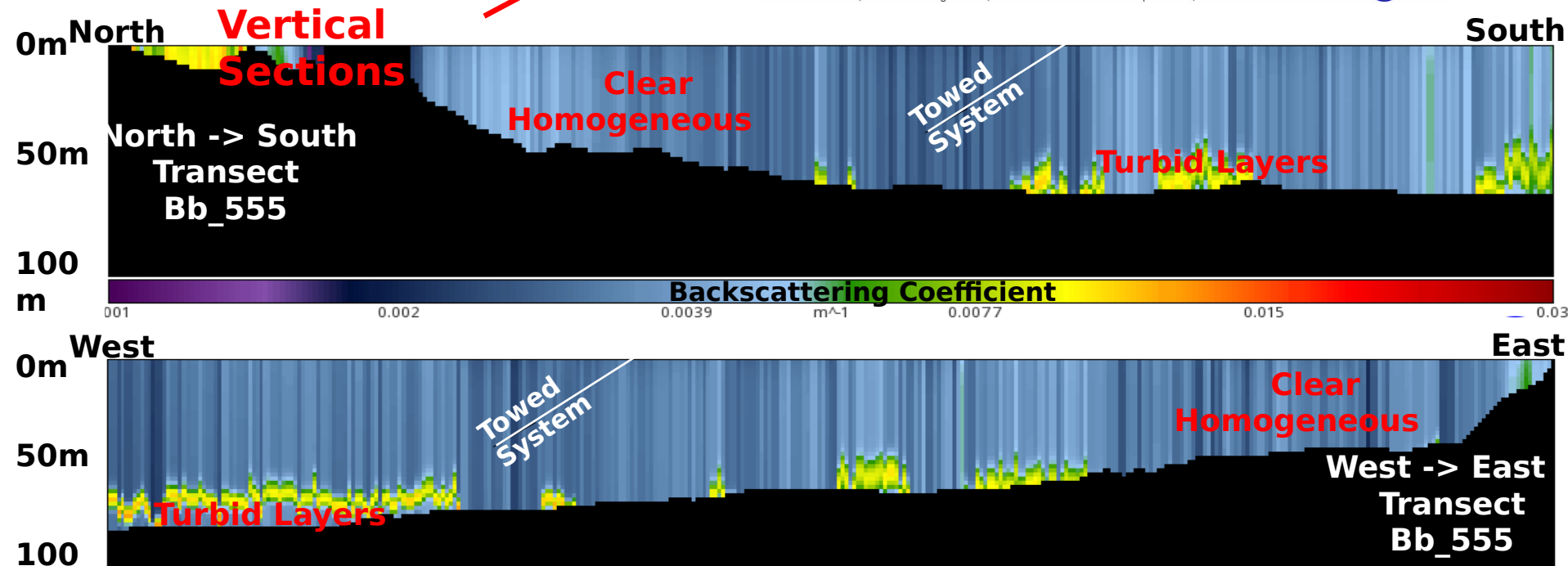
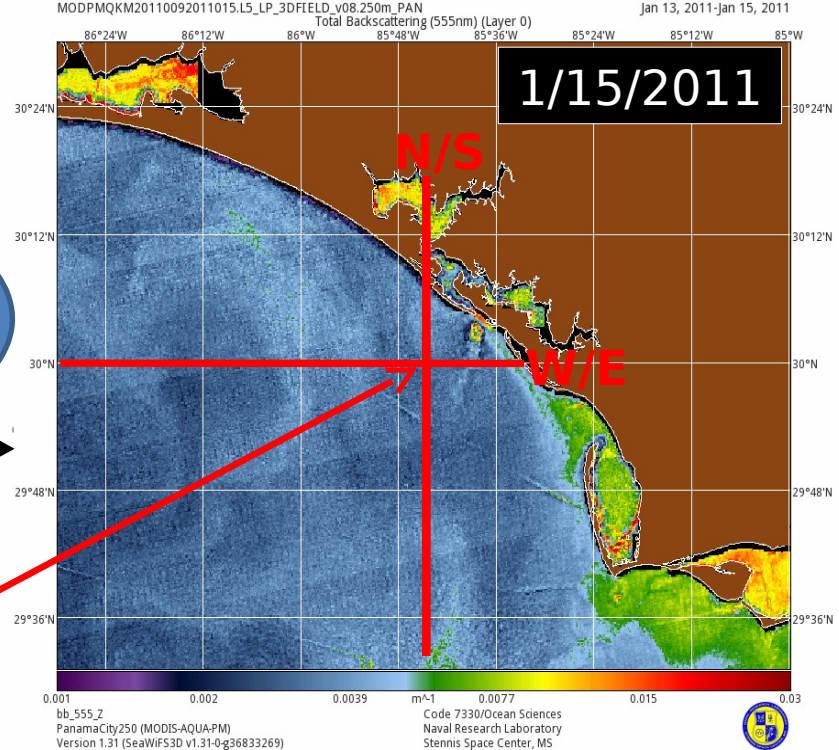
Vertical
Optical
profile



**250m
Resolution**

**3D Optical Volume
Created by
Merging
“Satellite, models and
Insitu data”
Surface to Bottom
Animation
(Black Areas are Bottom)**

LS
Need
Tuning
Daily
Using
Slider



Data Requested for NRL participation



- **Satellite data**



- **Ocean Models**



- **Vertical Optical Profiles**



- BSP (transmissometer)



- Slocum Gliders

- (attenuation meter)



- **Laser Line scan**



- Image Snipits**

- Feedback From Diver Ops**
- (If Available)**



Required	Requested 1	Requested 2	
a			Satellite data stream in place
a			Data stream in place
			Profiles use for: tuning optical Volume & validation
	a		
		a	
		a	Images used for validation
		a	Visibility Reports

Daily Exercise Support Products

VULCANEX (3/21/11 - 4/11/11?)

Current Glider Track and Location

Forecast

Waypoints

CW 3/25/11

~20Z

G1 3/26/11

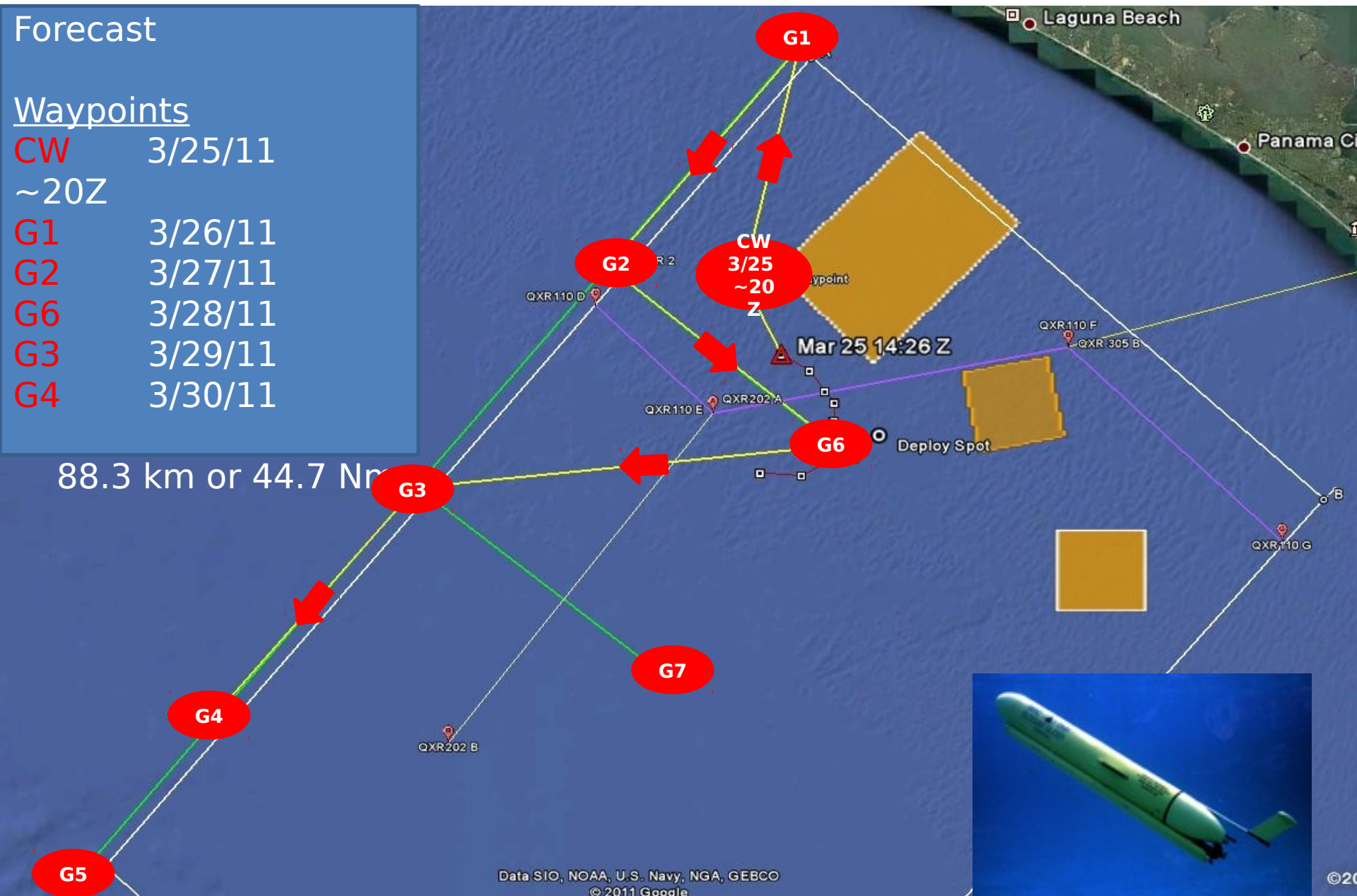
G2 3/27/11

G6 3/28/11

G3 3/29/11

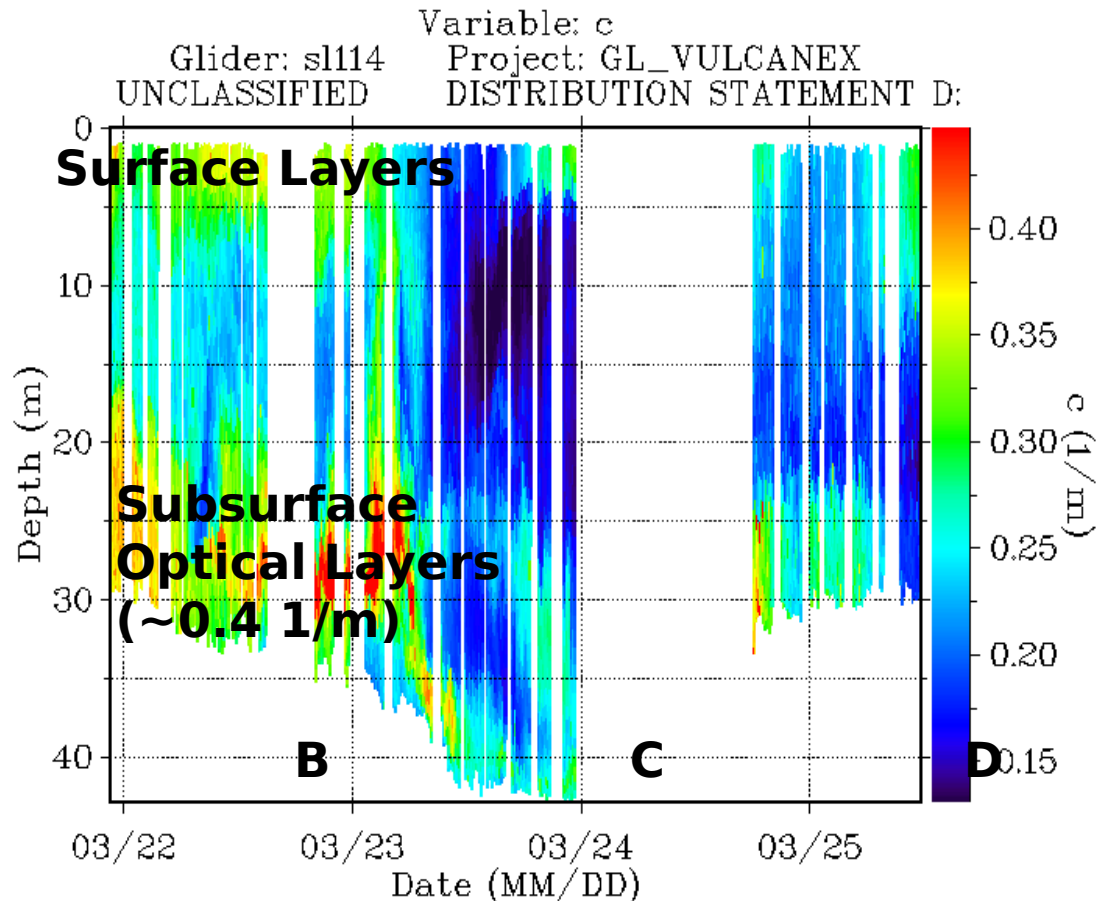
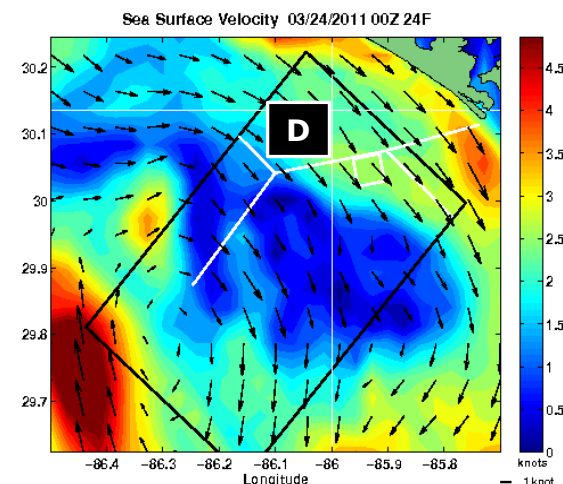
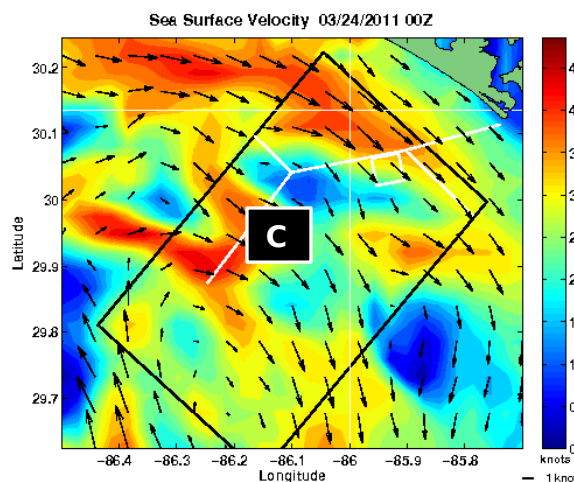
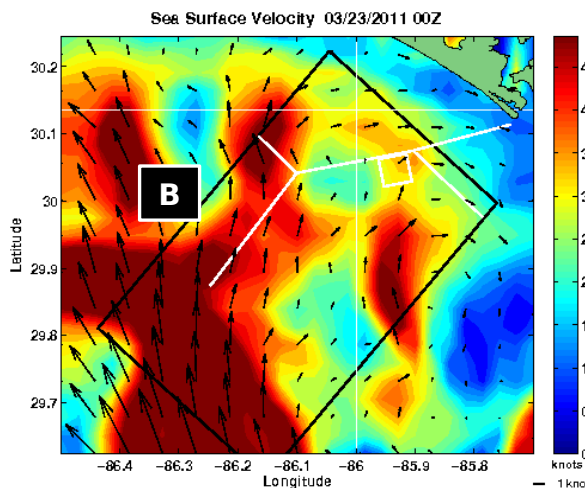
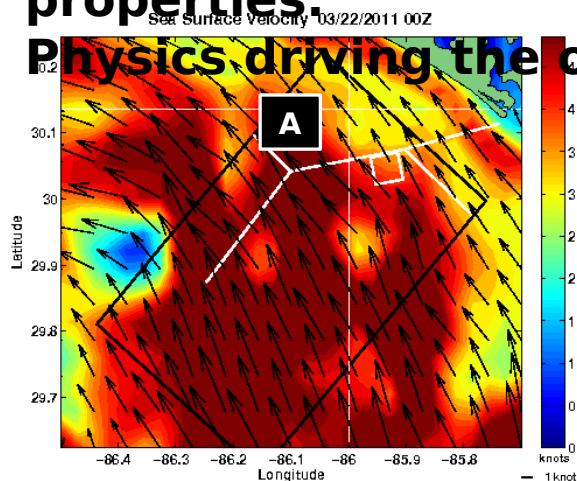
G4 3/30/11

88.3 km or 44.7 Nm



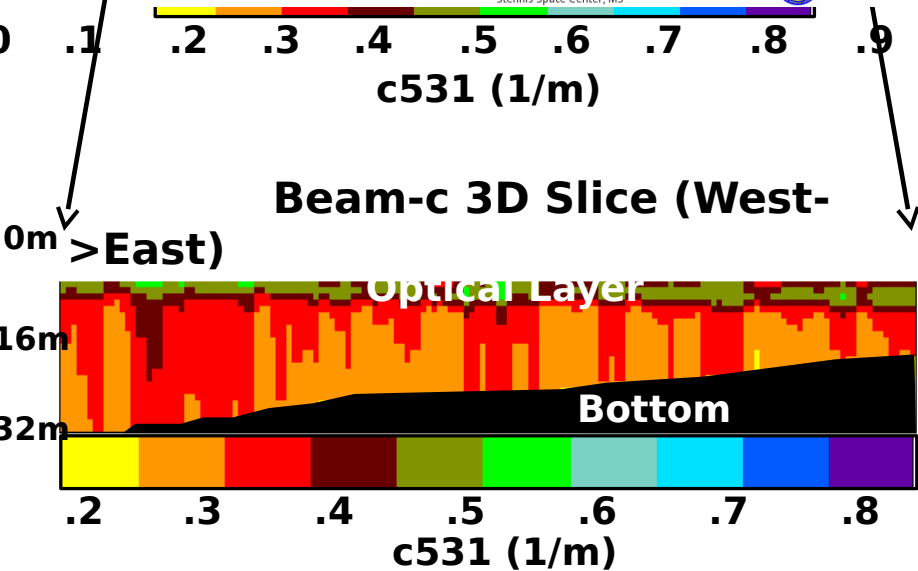
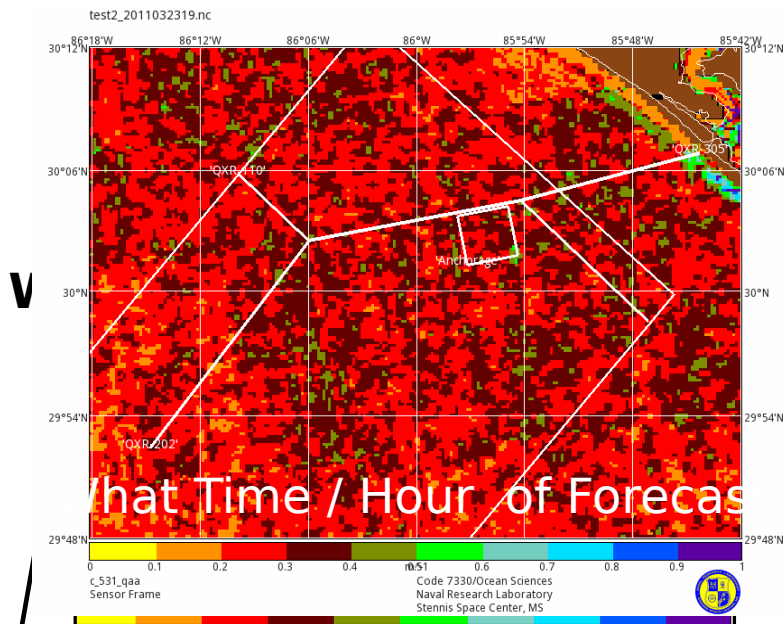
Current direction and speed can change within 24 hours period causing subtle changes in surface and subsurface optical properties.

Physics driving the optics.

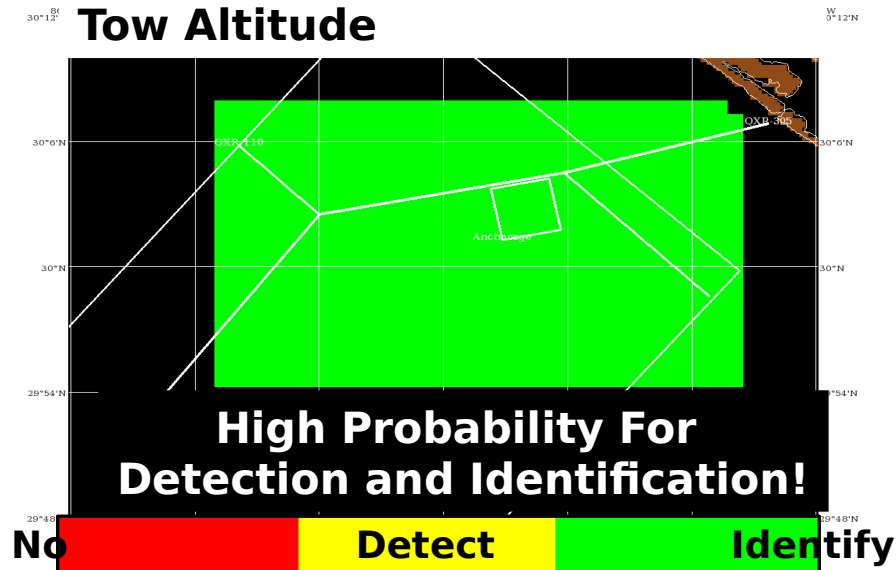


NowCast AQS-24 Support for March 23, 2011 19Z

Surface Beam-c (NowCast)

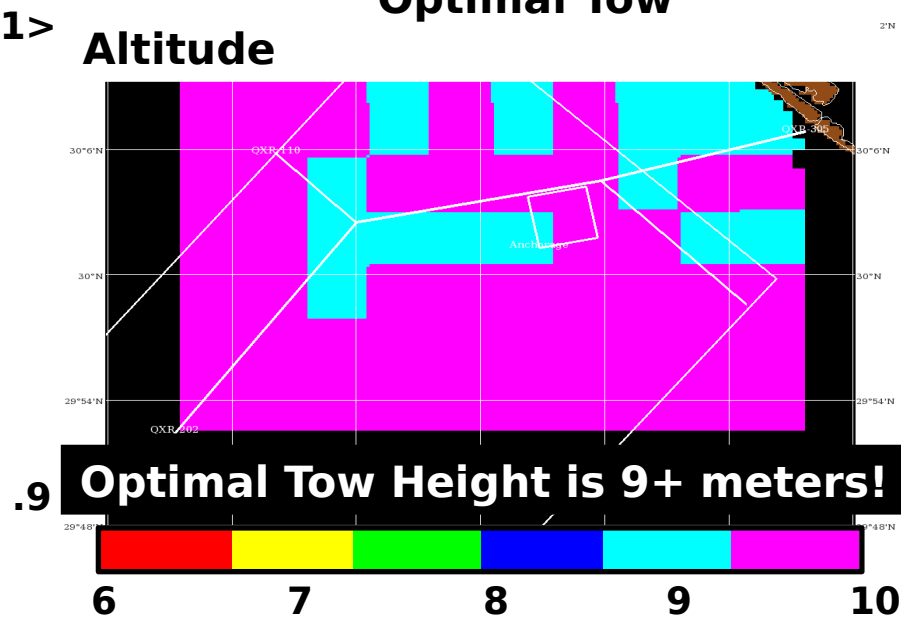


Target Identification @ 6m Tow Altitude



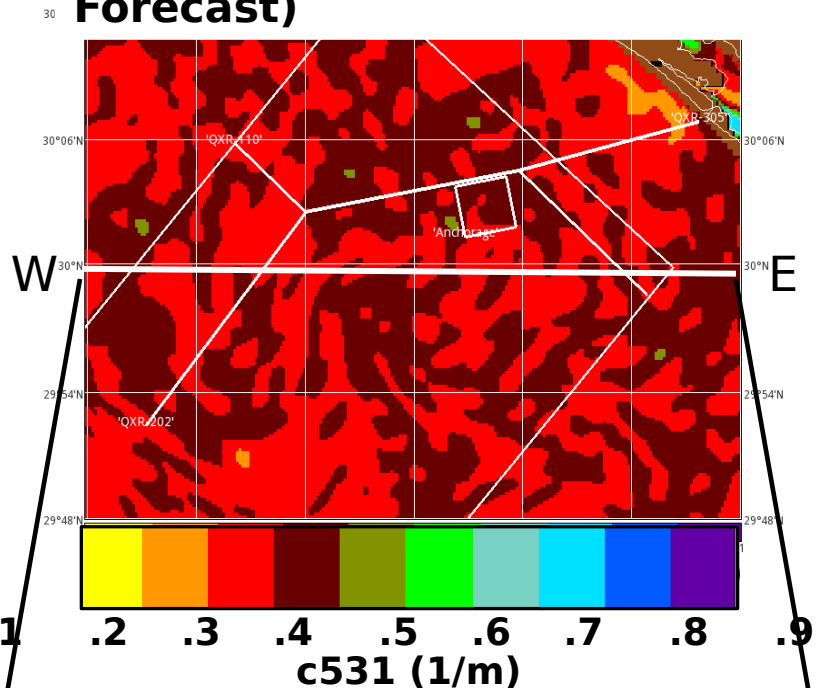
Optimal Tow

Altitude



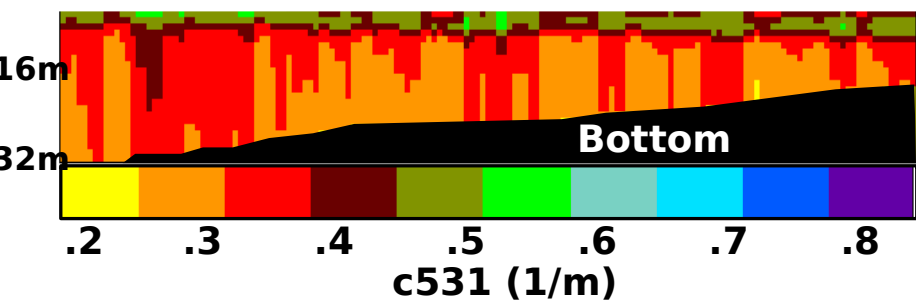
Forecast AQS-24 Support for March 24, 2011 19Z

Surface Beam-c (24 Hour Forecast)



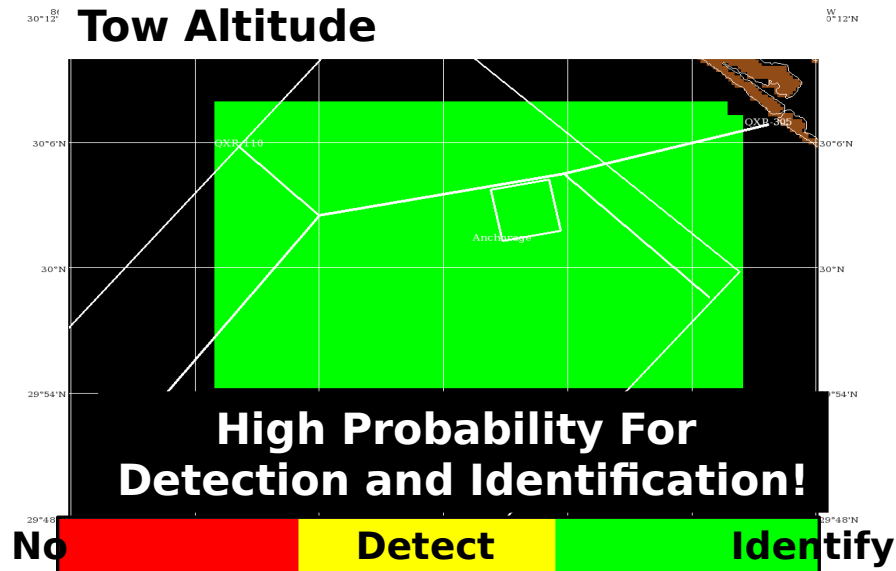
Beam-c 3D Slice (West-East)

0m > East



<5

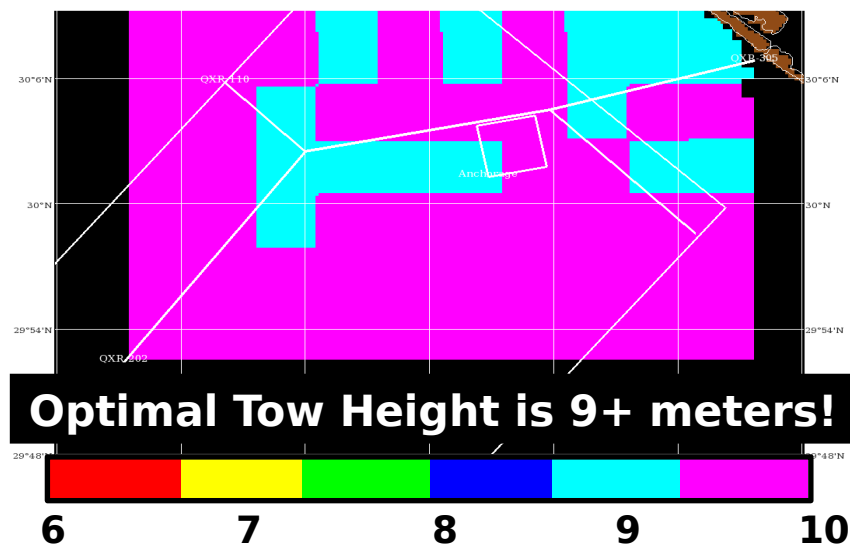
Target Identification @ 6m Tow Altitude



Optimal Tow Altitude = 9+ meters

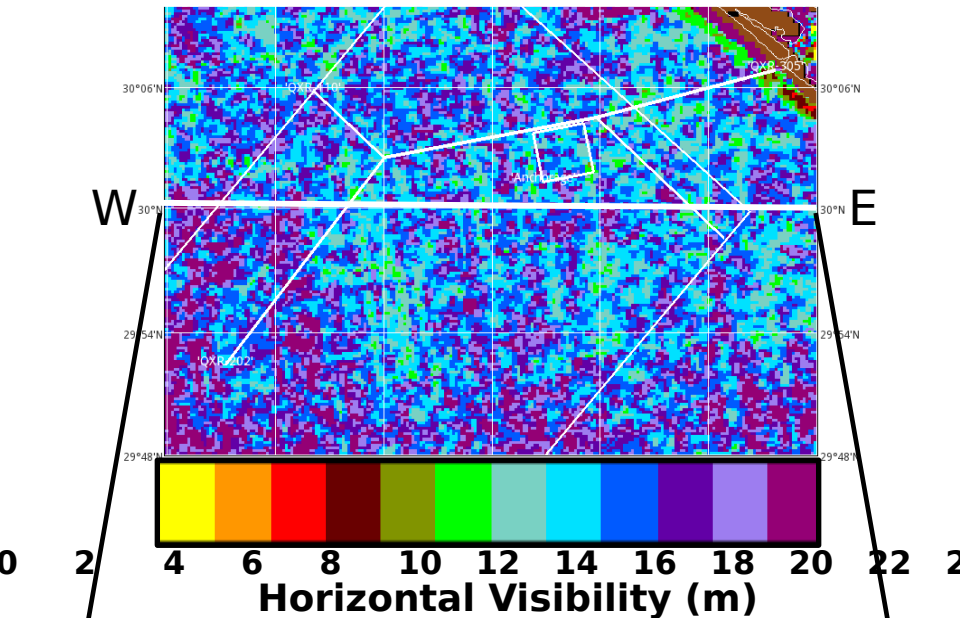
1>

.9

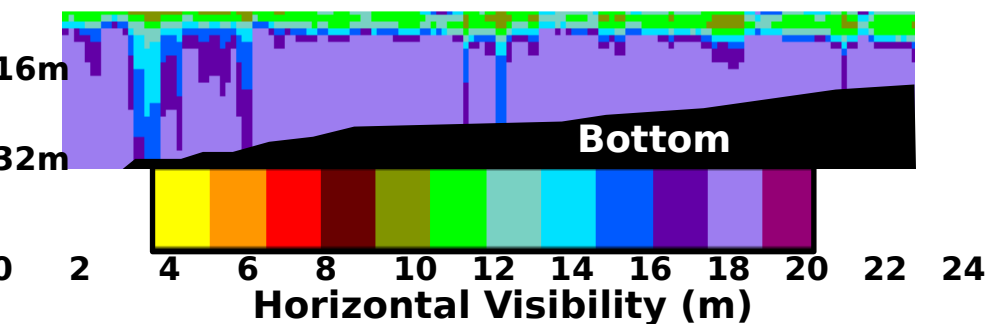


NowCast Dive Support for March 23, 2011 19Z

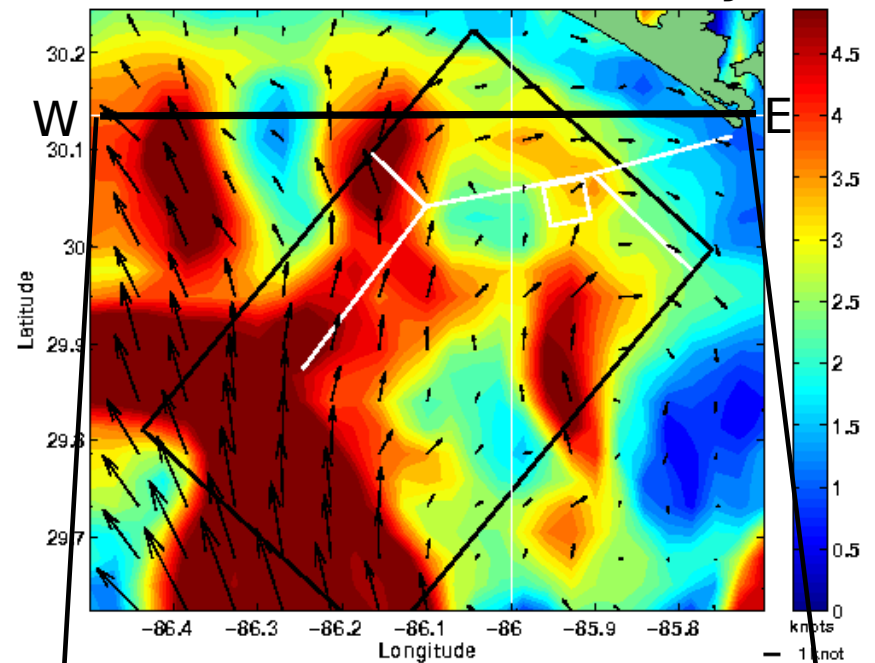
Surface Horizontal Diver Visibility (NowCast)



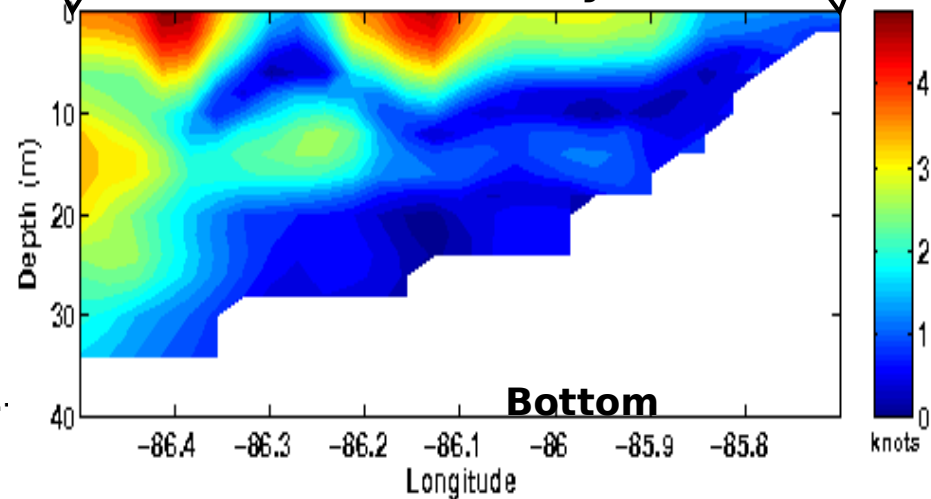
Diver Visibility 3D Slice (West->East)



Surface Current Velocity

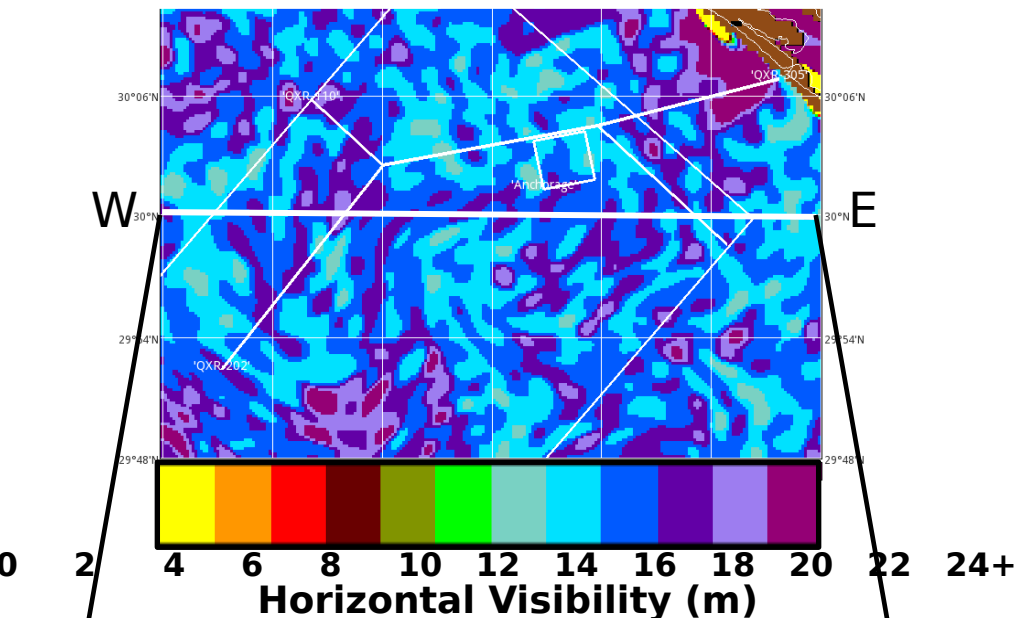


Subsurface Current Velocity Slice at 30.14

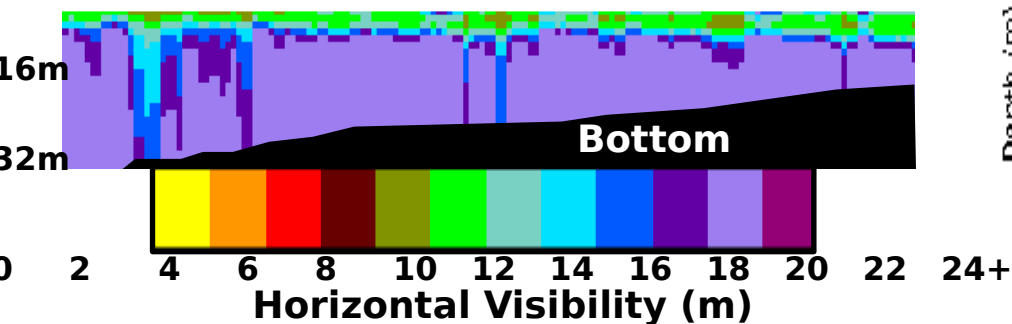


Forecasted Dive Support for March 24, 2011 19Z

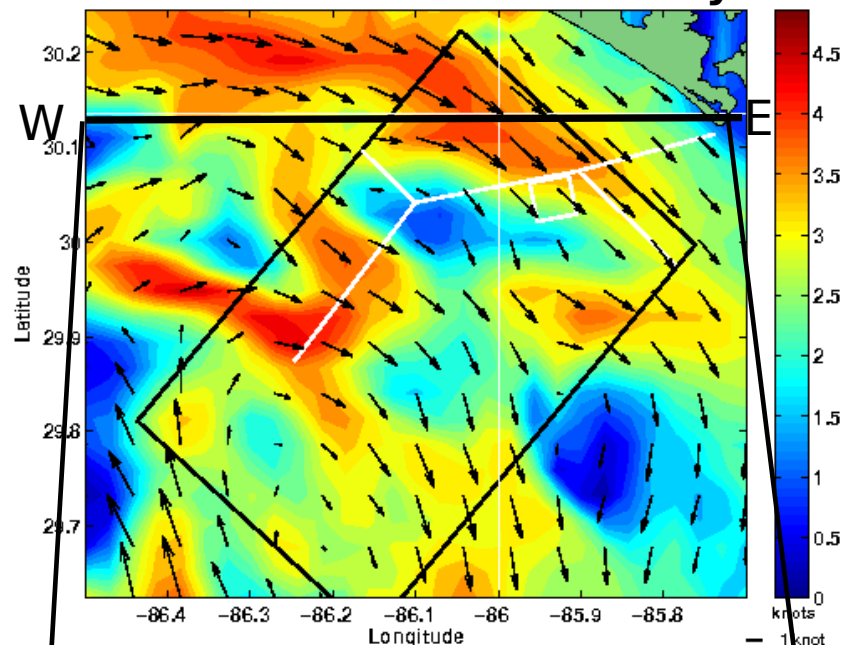
Surface Horizontal Diver Visibility (24Hr Forecast)



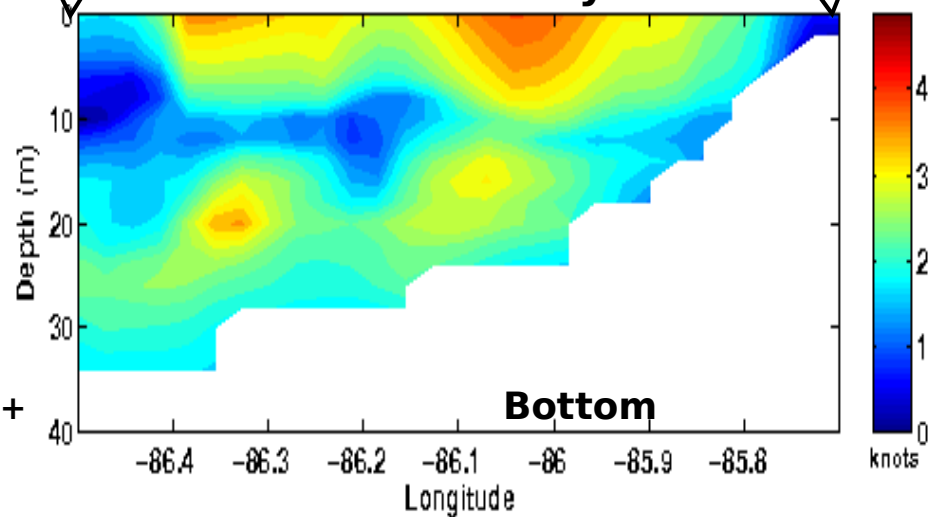
Diver Visibility 3D Slice (West->East)



Surface Current Velocity



Subsurface Current Velocity Slice at 30.14



Summary Slide – From Kevin

Questions?

Please send any feedback via email (ladner@nrlssc.navy.mil)

Positive

Negative

How Products being used?

Changes?